DOCUMENT RESUME

ED 288 370 FL 017 010

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TITLE Time-Binding in Mother-Child Interactions: The Morphemes for Future and Past.
PUB DATE Apr 87
NOTE 9p.; In: Papers and Reports on Child Language Development, Volume 26; see FL 017 001.
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Case Studies; *Child Language; Cognitive Processes; English; Interaction; *Language Acquisition; Learning Processes; Morphemes; *Mothers; *Parent Child Relationship; *Parent Influence; *Time Perspective; Word Frequency
IDENTIFIERS Error Correction (Language)

ABSTRACT

A study examined the teaching and learning processes in the mother-child interaction that lead to the child's acquisition of the English morphemes for future and past. Data were drawn from transcripts of a mother and daughter's interaction during a period of active acquisition, age 22 to 27 months. Longitudinal microanalytic and macroanalytic methods were combined to study immediate cause-effect relationships, more extended learning periods, and long-term incremental processes that led to performance improvements. Patterns were found in the frequency of future and past morpheme use, context of morpheme use, feedback to spontaneous utterances, progress from restricted formula to generalized use of morphemes, and interaction types (imitative, cued, and spontaneous) involving temporal morphemes. (MSE)

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Time-binding in mother-child interactions: The morphemes for future and past.

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Profound paradigmatic changes have been and are occurring at present in the field of developmental psycholinguistics. Since the emphasis of Bolinger (1976) on formulaic speech and Braine's (1976) demonstration of 'limited scope formulae' in infant speech, the research community has again become alert to the fact that by far not all utterances are produced by rule-governed processes. Accordingly, McWhinney (1978) postulated three possible processes in first language acquisition: 'rote,' 'analogy,' and 'rule.' More recently, the principle of pattern abstraction, McWhinney's 'analogy,' has received extensive scrutiny and support in the studies of Rumelhart & McClelland (1985) and Bybee and Slobin (1982) who demonstrated that a considerable amount of phenomena observed in the acquisition of temporal morphemes might be due to such pattern abstraction as contrasted to rule learning.

With these emphases upon processes, an integration of two research trends becomes possible: The study of (a) psychological processes and (b) of the interactional processes between adult and child that lead to learning and support the cognitive processes employed by the child as postulated by Vygotsky (1978) and Bruner (1983). This research, initiated by Moerk (1972) and Snow (1972) and elaborated upon especially by Cross (1977, 1978) explores these interactions in a microlongitudinal manner to show how interactional processes guide and define cognitive processes in the child. Interactions entail relational information, as contrasted to punctuate aspects, as emphasized by Cross (1977), Moerk (1983), Shatz (1982), and Snow (1977). Feedback in the form of corrections (Demetras, Post, & Snow, 1986; Hirsh-Pasek, Treiman, & Schneiderman, 1984; Moerk, 1983) is part of this relational information. The old controversy as to 'the effect of imitation' and the definition of 'imitation' can be resolved (see: Snow, 1983 and Moerk, 1985) by demonstrating that similarity to the model and temporal delay are two dependent variables in the model-imitation interactions that indicate the degree of storage and independent retrieval in the child.

Taking into account these promising developments, the present study focuses upon a domain, the English morphemes for future and past, for which the necessity of learning is uncontroversially accepted, and explores the teaching/learning processes that lead to the acquisition of these morphemes.

Method

The extensive transcripts of R. Brown, pertaining to Eve's interactions with her mother, were reanalyzed to explore

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psychological processes and mutual influences in the transmission and acquisition of temporal morphemes. The analyses were focused upon the age period of 22-27 ms, with a MLU range between 2.75 and 4.0, a period of active acquisition of these morphemes. Longitudinal microanalytic and macroanalytic methods were combined to study immediate cause-effect relationships as well as more extended learning periods and long-term incremental processes that led to improvements in filial performance.

Results

An overall impression of the acquisition process can be gained from a longitudinal survey over the entire period studied combined with an attempt to discern interactional dynamics. This is presented in Table 1.

Table 1

Frequencies per Hour of Use of Future Morphemes

	Morpheme	S 9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19
A	will/'11											
d	shall/'11	16	14	16	10	18	23	19	24	17	30	32
u	going to/											
l	gonna	6	4	5	12	4	7	11	6	14	18	14
t												
C	go + verb	1	2	3	15	6	6	12	15	5	7	1
h	going to											
i	gonna	1	3	1	1	1	2	3	5	3	6	7
l	will/'11											
d	shall/'11	1	1	0	1	1	5	1	3	1	5	10

The increase with age in most of the phenomena is easily visible from an inspection of the data. The correlation coefficents range in the 70's and 80's. The one instructive exception pertains to Eve's "go"+ verb, such as "go get," "go bring." This semantically most transparent expression of a future intention, describing both the preparatory locomotory and the goal action, reaches an early peak in sample 12, increases once again, and then declines steeply toward the end of the recording period. Interactionally, a lead-lag relationship between Eve and her mother can be overserved. After Eve's peak in S 12, the mother steeply increase her models of "will/shall" after a lag of one sample; and again, after Eve's second peak in samples 15 and 16, the mother adds another spurt after a lag of two samples. A similar increase in maternal models of "going to/gonna" follows in sample 17, i.e., after a lag of one sample. In both cases, Eve indicates her readiness for the expression of the future, though through a semantically transparent morpheme, and her mother responds by modeling the linguistically preferable morphemes. The high

correlations between Eve's common future morphemes and age show the cumulative effects of input and exercise frequency.

Table 2 presents a first attempt to differentiate more finely probable causative factors that lead to filial progress; this time in regard to the regular past.

Table 2

The More Frequent Verbs Taking the Regular Past Employed in Contexts where the Past is Obligatory

Verbs	Frequencies Adult	Frequencies Eve Correct	/-ed/ missing	Total	% Eve Correct
Happen	28	7	3	10	70
Say	15	10	4	14	71
Fix	10	3	4	7	42
Spill	7	11	3	14	78
Fold	7	7	0	7	100
Drop	5	3	6	9	33
Use (used to)	5	0	-	0	-

Frequency effects again become quite plausible as seen by comparing Adult Frequency and Percent Correct. The correlation is, however, only .33, indicating that other factors interact with input frequency. Acoustic distinctiveness seems most decisive, as seen in the case of "folded" which alone reaches 100 percent correctness. This is the only verb in Table 2 wherein the past tense is formed with the "-ed" allomorph. A preliminary rank-ordering of the six verbs Eve used, according the acoustic distinctiveness of their past tense suffixes, resulted in a rank order correlation with Percent Correct of .94. Pragmatic factors arise in "spill" and "drop," since both verbs are predominantly employed to describe Eve's own actions. They are used more often than mere input frequencies would lead to expect. Yet, these factors, combine with acoustic distinctiveness, the dental suffice being more distinct after /l/ than after /p/, resulting in a higher level of correct performance for "spilled." Finally, semantic opacity, as in the past tense of "use" in the form of "used to," is important. This phrase is never employed by Eve, in spite of its input frequency being the same as for "dropped." Most generally, it needs to be emphasized how the results in Table 2 argue against involvement of rules in Eve's performance. Whether with the same vocabulary items or with different ones, Eve's provision of the past morpheme is not reliable, as rule-governed behavior should be. Other variables, whether in models or in feedback, influence Eve's productions.

Since Eve employed diverse forms to express future intent and was differentially successful in producing the past-tense suffix, where obligatory, it is of great interest how her mother responded to these attempts. This maternal feedback is summarized in Table 3.

Table 3

Maternal/Adult Feedback to Eve's Spontaneous Utterances

	Utt. type	S 9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19
F	Morpheme omitted	3‡ / 17	0 / 6	0 / 7	5 / 7	6 / 13	0 / 11	2 / 12	2 / 10	3 / 10	10 / 12	0 / 11
u t u r e	Go + verb	3 / 0	2 / 0	0 / 4	13 / 10	2 / 11	3 / 2	6 / 10	6 / 8	5 / 1	2 / 3	0 / 0
	Going to gonna	-‡‡	-	-	-	-	-	-	2 / 3	5 / 0	4 / 3	2 / 1
	Will/'ll	-	-	-	-	-	-	-	1 / 5	0 / 1	0 / 3	0 / 5
P a s t	Correct/ M accepts	8# / 5	11 / 5	9 / 5	22 / 5	23 / 4	9 / 3	28 / 12	9 / 5	33 / 9	34 / 10	22 / 4
	Incorrect/ M corrects	19# / 10	13 / 2	18 / 9	14 / 9	21 / 14	8 / 3	23 / 13	24 / 9	25 / 13	15 / 6	3 / 2

‡ = going to/gonna / will/'ll # = N of Eve's productions / N of M's feedback

‡‡ = No spontaneous filial productions

Much of Table 3 is again self-explanatory and the interpretation can be brief. If Eve omits the future morpheme where obligatory, her mother provides predominantly the formal morpheme "will/'ll" as feedback. In contrast, when Eve employs either "go" + verb or "going to/gonna" her mother adjusts and is more prone to employ "going to/gonna" to express the future in her feedback. Even more impressive becomes this fine-tuning when Eve begins to employ "will/'ll." In 14 out of 15 cases, her mother responds with the same future morpheme. In all these cases, it can be presumed with confidence that the maternal matching serves also as a sign of agreement for Eve, signifying that her attempt was correct.

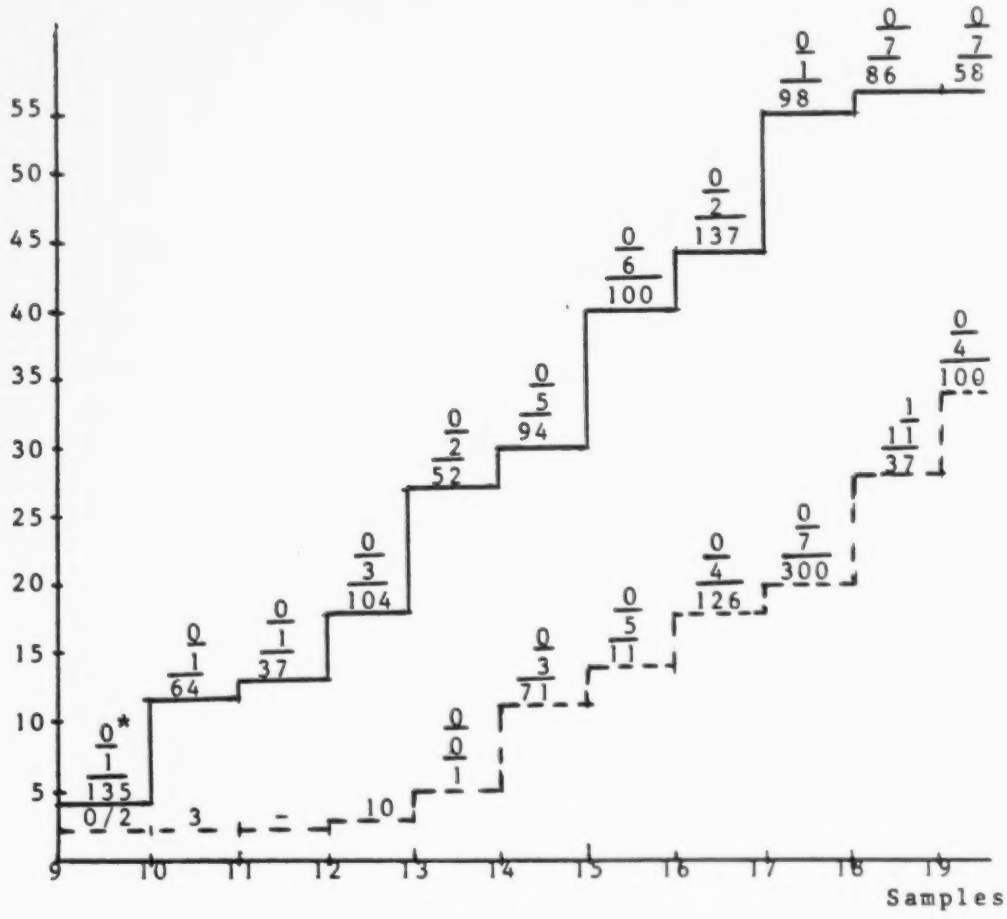
For the past tense, only instances of acceptance, when Eve was correct, vs. correction, when she omitted the obligatory morpheme, are summarized. It can be seen that in the early samples, Eve's correct productions receive confirmatory feedback in around 50 percent of the cases, a high amount of information in the form of intermittent reinforcement. If Eve omits the obligatory morpheme, feedback might be even more important and it is provided in 50 percent or more of the instances in most samples until the end of the recording period. These data suggest that the adult certainly is alert to filial performance and that Eve is quite reliably informed how close she was to the standard or when she deviated from it. This

relational information, provided almost immediately after a filial production, necessarily must contribute to filial learning.

This learning is represented in Figure 1, wherein the number of verbs used in the past and future tense and the factors influencing the productions are given.

Figure 1

Eve's progress from restricted formulas to generalized use of temporal morphemes and her gradual independence from input.



* = $\frac{\text{smallest}}{\text{median}}$ lag between the model/cue and Eve's product
largest

——— = cumulative frequency of verb types employed by Eve in the past tense

– – – = cumulative frequency of verb types employed by Eve in the future sense

The stepwise increase in verb types is obvious, indicating progress from a small number of restricted formulas to generalized use of the morphemes. But broadened use does not necessarily mean productive independence. As the numbers above each step indicate, Eve is prone until the end of the observation period to employ many constructions with a zero lag after a maternal model and even the median interval from a model is quite low until around samples 16 or 17. Close dependency upon a maternal cue is reflected in these numbers. Memory phenomena are obviously involved here: from short-term memory at a lag of zero to assured long-term memory with lags reaching or surpassing 100. Two aspects of productivity are encountered in this table: productivity in the generalization of the morpheme to a large number of verb types and productivity in the sense of becoming independent from a model.

Since previous tables and figures made it appear highly plausible that Eve did not follow a general rule, the question arises which psychological processes support this productivity. Table 4 will provide some first indications to answer this question.

Table 4

Interactional Aspects of Eve's Productions of Temporal Morphemes

	Type	S 9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19
P	Imit.	2‡/2	4/6	1/3	2/3	6/9	1/1	4/4	2/2	1/2	4/10	2/9
a	Cued	1/4	4/7	2/5	6/11	4/4	4/4	14/17	9/12	15/34	9/19	8/19
s t	Spont.	1/1	3/3	1/1	3/4	3/3	2/3	6/8	2/2	6/7	5/6	2/2
	Imit.	2/2	1/1	0	0	2/2	3/3	2/2	3/3	2/2	0	4/5
F u t u r e	Cued	0	0	0	1/1	1/1	2/2	1/1	2/2	1/1	7/9	5/7
	Spont.	0	0	0	0	0	1/1	0	3/3	2/2	2/2	3/3

‡ = Types/Tokens

Eve's productions are broken down in Table 4 into "imitative," "cued," and "spontaneous" ones. "Imitative" productions followed an identical maternal model. "Cued" productions followed a maternal model of the same tense but were produced with a different verb stem. They provide, therefore, indications for pattern analysis and

synthesis. Finally, "spontaneous" productions were formed without preceding maternal scaffolding.

Imitation remains an important factor throughout the recording period, though its proportional frequency declines. Cueing increases strongly in importance and it is the only category involving, at least toward the end, a broad range of verb-types, a fact that suggests pattern-based processes. "Spontaneous" productions remain relatively infrequent, especially in the case of the future, and could easily be based upon rote learning. Microanalyses have shown that they are often based upon fragments from picture books and nursery rhymes. The extremely limited scope of spontaneous productions, especially of the future, argues again against rule-based performance, supporting thereby many indications derived from preceding tables and figures.

Discussion

In a domain where the necessity of learning is obvious, its mechanisms were focused upon. Acoustic and semantic transparency in input leads to first productions. Maternal sensitivity to filial readines results in an increase in the frequency of modeling. Correlations between input variables (frequency and acoustic distinctiveness) and filial use are substantial. Differentiated feedback to filial productions entails four aspects: Fine-tuning, modeling of more advanced forms, confirming, and correcting responses provided in close to 50 percent of the instances. After the child has mastered the rudiments, production deficiency remains a problem. Adults alleviate it through cueing or priming. Whereas imitated productions remain temporally tied to their models, cues lead to production after increasingly longer lags, becoming incrementally more spontaneous with repetitions. With increasing mastery, the range of application expands from restricted formulas to many verb types. A multitude of determiners, such as recency of model/cue, strength of schema, based upon input frequency, or fine-tuning of schemas through affirmation/corrections, leads to probabilistic functioning, as contrasted to deterministic rule-based products.

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Acknowledgment

This work was supported by a grant from the Spencer Foundation and by release time provided by California State University, Fresno.